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(54) Disinfectant compositions

(57) Alcoholic microbiocidal compositions which contain reduced alcohol and anti-microbial concentrations, comprise an aqueous solution of a lower alcohol, an acid and an anti-microbially effective amount of an amino- or ammonium-based microbiocide, the pH of the total composition not exceeding 5. The reduced alcohol and microbiocide levels improve safety of handling and suitability for use on surfaces which contact food. The compositions demonstrate both disinfectant and preservative properties.

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SPECIFICATION **Disinfectant Compositions**

The present invention relates to disinfectant compositions and, in particular, to compositions comprising an aqueous solution of a lower alcohol and an anti-microbial compound, suitable for, although not restricted to food-processing disinfection and kitchen hygiene.

Hard-surface contamination by bacteria, yeasts and moulds represents a hazard in food processing and kitchen hygiene, and may result in food-poisoning micro-organisms being transferred to food products.

Accordingly, there is a need for disinfectant products which reduce the numbers of micro-organisms on food-contact surfaces to acceptable levels and help to prevent those surfaces from being re-contaminated.

Effective biocidal compositions are known in the art. In general, in order to achieve the necessary level of disinfecting action, they contain either high levels of alcohol, which is undesirable in view of the evident safety hazards during processing, storage and application, or they contain relatively high levels of one or more biocidal compounds, which is also undesirable for application to surfaces coming into contact with food products.

It has now been found that in compositions based on aqueous solutions of alcohol and conventional amino- or ammonium-based anti-microbial compounds, the inclusion of (preferably organic) acids in amounts sufficient to yield acid pH-values, allow a considerable reduction in the levels of both the alcohol component and the biocidal compound. This is particularly surprising since the biocidal compounds of this type are generally thought to be more effective at neutral or alkaline pH values.

Accordingly, the present invention provides a disinfectant composition on the basis of an aqueous solution of a lower alcohol, comprising an acidic compound and an effective amount of an amino- or ammonium-based anti-microbial compound, said composition having a pH which does not exceed 5.

Thus, we have found that the above-defined compositions according to the present invention, not only avoid the aforementioned disadvantages, but also provide disinfectants capable of both disinfecting action at application and preservative action after application, i.e. protecting the treated surface from re-contamination.

One essential component of the composition according to the present invention is an effective amount of an amino- or ammonium-based anti-microbial compound. These compounds, which comprise a tertiary or quaternary nitrogen atom, are well known in the art.

Suitable types include the quaternary ammonium compounds, such as the $\text{di}(\text{C}_8\text{--}\text{C}_{12})$ alkyl $\text{di}(\text{C}_1\text{--}\text{C}_4)$ alkyl ammonium halogenides; the amine oxides, such as $\text{R}_1\text{R}_2\text{R}_3\text{NO}$, wherein R_1 and R_2 when taken alone are short-chain alkyl radicals or when taken together are a morpholino radical, and R_3 is a $(\text{C}_8\text{--}\text{C}_{12})$ alkyl radical; the betaines and sulfo-betaines, such as the $(\text{C}_8\text{--}\text{C}_{16})$ alkyl dimethyl betaines or -sultaines, and the $(\text{C}_8\text{--}\text{C}_{16})$ alkyl amido betaines or -sultaines; the (halogenated) anilides, such as TCC and TBS; and the polymeric bis-guanides, such as chlorhexidine.

Preferably the quaternary ammonium halogenides, in particular didecyl dimethyl ammonium chloride such as Berdac 22 (a registered trademark by Lonza, Switzerland), and the bis-guanides such as Vantocil 1B (a registered trademark by ICI, United Kingdom) are used.

In general, the anti-microbial compounds are included in amounts of from 5 to 500 ppm, in particular 5 to 100 ppm. Preferred levels of the anti-microbial compound range from 20 to 50 ppm.

The second essential component of the compositions according to the present invention is a lower alcohol, i.e. an alkyl alcohol having from 1 to 4 carbon atoms in the alkyl radical, such as ethanol, n-propanol or isopropanol. Of particular advantage have been found ethanol and isopropanol, the latter of which, optionally in admixture with the first, is preferred. Where both are present, the volume ratio of ethanol to isopropanol is preferably from 1:1 to 1:3.

The concentration of the alcohol component is at least 10% v/v and normally lies within the range of from 10 to 50% v/v. Preferred are concentrations in the range of from 15 to 40% v/v, in particular 20 to 40% v/v.

The third essential component of the composition according to the present invention is an acidic compound to provide the composition with a pH of not more than 5. Although both mineral and organic acids capable of providing this pH may suitably be included, when intended for the particular field of application referred to above, it is preferred to use food-grade alkyl carboxylic acids or hydroxyacids. Suitable such acids include acetic, citric, fumaric, lactic, malic and tartaric acid, the preferred members of which are citric and lactic acid.

The acidic compound is included in an amount of from 0.1 to 10% by weight, and preferably in an amount of from 2 to 5% by weight. The amount should be sufficient to provide the composition with a pH-value of not more than 5, and preferably with a pH-value of from 2 to 4.

The composition according to the invention further comprises water and, optionally, minor ingredients to improve its effectiveness and/or consumer acceptability. More in particular, the composition may contain minor amounts of surfactants, wetting agents, colouring agents and perfumes.

The compositions according to the invention will normally be applied by spraying or sprinkling thereof onto the surface to be treated, in view whereof the composition may be fixed with a propellant to provide a formulation suitable for use as an aerosol spray.

Alternatively, the compositions may be applied to the surface being impregnated in a substrate of woven or non-woven (e.g. paper) material to form a disinfectant wet wipe.

The invention will now be further illustrated by way of example.

Example 1

5 Compositions were tested having the following basic formulation: 5

isopropanol	30% v/v
acid	0.1 or 1% by weight
didecyl dimethyl ammonium chloride	25 or 50 ppm
water	balance

10 The compositions were adjusted to pH=by HCl or NaOH. 10

The anti-microbial activity was measured against two yeasts, *Saccharomyces cerevisiae* and *Zygosaccharomyces rouxii*, using the quaternary ammonium compound at a level of 50 ppm, and against one type of bacterium, *Escherichia coli*, using the quaternary ammonium compound at a level of 25 ppm. The anti-microbial activity was measured by way of a standard suspension test at 25°C and using a contact

15 time of 5 minutes. 15

The data in Table 1 demonstrate the significant enhancement of the activity of the quaternary ammonium compound by organic acids, in particular at the 1% by weight levels.

TABLE 1
Log₁₀ reduction in viable counts in the presence of 50 ppm (yeasts)
or 25 ppm (*E. coli*) didecyl dimethyl ammonium chloride

20 20

Acid	%	S. cerevisiae	Z. rouxii	E. coli
None added		2.18	0.00	2.10
Orthophosphoric	0.1	2.17	0.00	2.11
	0.1	3.87	0.40	4.70
Sulphamic	0.1	2.72	0.08	2.20
	1.0	3.45	0.09	4.05
Glycolic	0.1	3.42	0.46	2.47
	1.0	>4.60	3.46	>5.10
Acetic	0.1	—	—	2.44
	1.0	—	—	>5.73
Acetic:Formic	(1:1)			
	0.1	—	—	3.74
	1.0	>4.60	>4.60	>5.10

35 Example 2

A composition was formulated comprising 30% v/v isopropanol, 1% by weight acetic acid, 25 ppm of didecyl dimethyl ammonium chloride and water. This composition was compared with the same composition without the ammonium compound to test its anti-microbial activity when sprayed onto *Staphylococcus aureus* bacteria dried on PCV tiles. The *Staphylococcus aureus* bacterium has been found to be one of the most resistant vegetative when dried onto hard surfaces and it also constitutes a food-poisoning risk. From Table 2 it is evident that the composition containing both the acid and the ammonium compound is highly effective.

40 40

TABLE 2

	Spray composition	Log ₁₀ Bacteria recovered 2 hours after spraying	
	Water	4.2	
5	30% isopropanol+1% acetic acid	4.1	5
	30% isopropanol+1% acetic acid and 25 ppm QAC	<2.3	

EXAMPLE 3

- Compositions containing 30% v/v of isopropanol, 25 ppm of didecyl dimethyl ammonium chloride, the amounts and types of acids indicated in Table 3 and water were tested in the same manner as in Example 2. The results in Table 3 clearly indicate that also other types of food-grade organic acids can suitably be used to achieve satisfactory anti-microbial action.

TABLE 3

	Spray liquid	Log ₁₀ reduction in viable bacteria after:	
		5 min	2h
	Water	0.1	1.5
	Isopropanol	0.8	2.6
	Isopropanol+2% lactic acid	3.7	4.9
20	Isopropanol+5% lactic acid	4.7	>5
	Isopropanol+2% citric acid	4.2	>5
	Isopropanol+5% citric acid	>5	>5
	Isopropanol+2% acetic acid	>5	>5
	Isopropanol+5% acetic acid	>5	>5

25 CLAIMS

1. A disinfectant composition on the basis of an aqueous solution of a lower alcohol, comprising an acidic compound and an effective amount of an amino- or ammonium-based anti-microbial compound, said composition having a pH which does not exceed 5.
2. A composition according to claim 1, wherein the anti-microbial compound is selected from quaternary ammonium, amine oxide, betaine, sulpho-betaine, halogenated anilide, and polymeric biguanide compounds.
3. A composition according to either preceding claim, wherein the anti-microbial compound content is from 5 to 500 ppm.
4. A composition according to claim 3, wherein the anti-microbial compound content is from 20 to 50 ppm.
5. A composition according to any preceding claim, wherein the lower alcohol comprises ethanol and/or isopropanol.
6. A composition according to claim 5, wherein the lower alcohol comprises ethanol and isopropanol in a volume ratio of from 1:1 to 1:3.
7. A composition according to any preceding claim, wherein the lower alcohol content is at least 10% v/v.
8. A composition according to claim 7, wherein the lower alcohol content is from 20 to 40% v/v.
9. A composition according to any preceding claim, wherein the acidic compound is a food-grade alkyl carboxylic acid or hydroxy acid.
10. A composition according to claim 9, wherein the acidic compound is citric acid or lactic acid.
11. A composition according to any preceding claim, wherein the acidic compound content is from 0.1 to 10% by weight.

12. A composition according to claim 11, wherein the acidic compound content is from 2 to 5% by weight.

13. A composition according to any preceding claim, having a pH of from 2 to 4.

14. A disinfectant wipe comprising a substrate impregnated with a composition according to any
5 preceding claim.

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